

Tanta University — Department: Electronics and Communications Eng. — **Faculty of Engineering**

Total Marks: 90 Marks

Course Title: Digital Electronics in communication systems	Course Code: EEC3111	Third Year
Date: 14-1-2016	Allowed time: 3 hrs	No. of Pages: (2)

Answer all the following questions:

Question (1) (20 mark)

1. Explain the operation of a NAND gate with a totem-pole output.
2. Describe the difference between current sinking and current sourcing.
3. Explain the principle of a Schottky TTL and its advantages.
4. What must be done to interface the standard CMOS logic family to TTL family?

Question (2) (15 mark)

1. Construct an 8-to-1 line multiplexer with enable input.
2. Design a 16-to-1 multiplexer using two 8-to-1 multiplexers having an active LOW ENABLE input.
3. What is a demultiplexer and how does it differ from a decoder? Can a decoder be used as a demultiplexer? If yes, from where do we get the required input line?

Question (3) (15 mark)

1. With the help of a suitable circuit, briefly explain how an S-R Flip-Flop can be used as a D Flip-Flop.
2. Derive the expression for Q_{n+1} in terms of Q_n and J and K inputs for a clocked J-K flip-flop with active LOW J and K inputs.
3. What is glitch? What causes it (explain with waveform)? How to overcome it?

Question (4) (25 mark)

1. Design a MOD.5 ripple counter that counts in the sequence 6,7,8,9,10,6,7,8,9,10,6,...and so on.
2. Draw the diagram for a MOD-16 ripple down counter. If the counter is initially in the 0110 state, what count will it reach after 37 clock pulses?

3. Design a 3-bit synchronous counter that counts as 101, 010, 000, 111, 101... using a D type flip-flop. Ensure that the unused states of 001, 011 and 100 go to 000 on the next clock pulse. Draw the state transition diagram.

Question (5) (15 mark)

1. Determine the frequency of the pulses at points x, y, z, and w in the circuit of Figure (2).

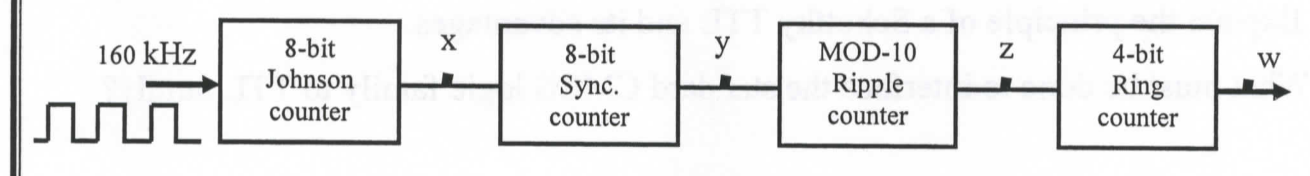
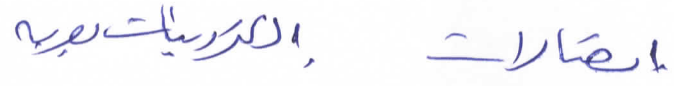


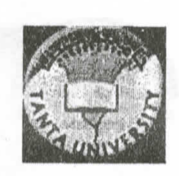
Figure (2)

2. Design a 4-bit Universal register which can be used as SISO, SIPO, PISO, or PIPO shift register.
3. An 8-bit universal shift register contents are 11000110. What are the register contents after 2 right shifts, 3 left shifts and 1 right shift? D_{in}=1.

Good Luck

Dr. *Entessar Saeed*







Electronics and Electrical Comm. Dept.
Total Marks: 100 Marks
First term Exam

Course Title: **Optical Electronics**	Course Code: EEC 3112	Year: 3rd
Date: 17-1-2016	Allowed Time: 3 Hours	No. of Pages: (2)

Answer the following questions:

Question (1) [25 marks]

(a) **Compare** between the following three different types of communication systems.

1. Wired communication system.
2. Wireless communication system.
3. Optical communication system.

(b) **Derive** an expression for the acceptance angle in optical fiber.

(c) **Define with drawing** the modes in optical fiber.

(d) **Compare** between the meridional rays and skew rays.

(e) For a step index fiber having a $20\mu m$ core radius, $n_1 = 1.48$, and $n_2 = 1.46$. **Determine:**

1. The normalized frequency at $1.3\mu m$.
2. The number of modes propagate in this fiber at $1.3\mu m$.
3. The percentage of optical power flows in the cladding.
4. If the incidence angle of the light ray on the core-cladding interface is $\Phi_1 = 85^\circ$ **calculate** the phase shifts δ_n *and* δ_p of the normal and parallel electrical field components in case of total internal reflection.

Question (2) [25 marks]

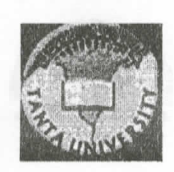
a) Formulate an approximate expression for modal dispersion in step index multimode fiber using the geometry of the fiber and the ray propagation in multimode fibers.

b) Define chromatic dispersion. What is the causes for its existence in optical fibers? Describe the techniques for eliminating it.

c) A multimode step index fiber $70/130\ \mu m$ with $n_1 = 1.44$ and $n_2 = 1.40$. The source produces nm wavelength. Find the critical curvature radius and the attenuation factor if $c_1 = 3c_2 = 9$.

d) An 5 Km optical fiber with $70/130\ \mu m$ and $n_1 = 1.44$ and $n_2 = 1.40$. A source with $\lambda = 1510\ nm$ and a linewidth of $30\ nm$ is used to generate the light that propagate through the fiber. Calculate:

1. The modal dispersion in $ps.Km^{-1}$ if these specification are for a step index fiber
2. The modal dispersion in $ps.Km^{-1}$ if these specification are for a graded index fiber at g_{opt} and $= 0.8g_{opt}$.





Electronics and Electrical Comm. Dept.
Total Marks: 100 Marks
First term Exam

Course Title: **Optical Electronics**	Course Code: EEC 3112	Year: 3rd
Date: 17-1-2016	Allowed Time: 3 Hours	No. of Pages: (2)

3. The approximate maximal data rate using the results in (i) and consider that the material dispersion is $20ps/km.nm$ and the waveguide dispersion is $-15ps/km.nm$

Question (3) [25 marks]

a) With the aid of sketches, indicate the main source for losses in splicing of optical fibers?

b) Compare the methods for fiber splicing

c) A 15×15 star coupler is used to distribute the 40 dBm power of a laser diode to 10 fibers. The excess loss ($Loss_{ex}$) of the coupler is 2 dB. Find the power at each output fiber in dBm and μW.

Question (4) [25 Marks]

a) What are the requirements that must be available in the light sources?

b) What are the differences between ELED and SLED?

c) Explain the operation principle of LASER diode.

d) Illustrate the effect of temperature on LASER diode.

e) Explain what is the meaning of the double Heterojunction LED and its advantage.

f) A GaAs LED radiates at 900 nm. If the forward current in the LED is 20 mA, calculate the power output, assuming an internal quantum efficiency of 5%.

Course Coordinator: *Dr. Amr Hussein*





Electronics and Electrical Comm. Dept.
Total Marks: 90 Marks
First Term

Course Title: **Wave Propagation and Antennas (1)**	Course Code: EEC 3110	Year: 3rd
Date: 21-1-2016	Allowed Time: 3 Hours	No. of Pages: (2)

Answer the following questions:

Question (1) [18 marks]

(a) **Explain** why the microwave network problems are not solved using circuit theory.
(b) **Derive** an expression for a transmission line characteristic impedance.
(c) A transmission line has the following parameters, $R = 12\ \Omega/m$, $L = 4\ mH/m$, $C = 0.009\ \mu F/m$, and $G = 0.07\ \mu\Omega^{-1}/m$ calculate:

1. Transmission line characteristic impedance Z_o.
2. Propagation constant γ.
3. Phase velocity v_p at $\omega = 1500$ radians/sec.
4. If the transmission line length is $l = 0.25Km$ determine the total **phase shift** and **attenuation** along the line.

Question (2) [18 marks]

(a) For a T.L of characteristic impedance Z_o terminated with a load Z_L, **derive** an expression for the T.L input impedance Z_{in}.
(b) **Explain with necessary equations** how a transmission line be used as a pure resistance.
(c) **Explain with necessary equations** how a transmission line be used as a pure inductance.
(d) **Explain with necessary equations** how a transmission line be used as a pure inductance.

Question (3) [18 marks]

(a) For a slotted line of characteristic impedance Z_o terminated with load impedance Z_L, **derive** an expression for the minimum distance l_{min} from the load to the first minimum voltage.

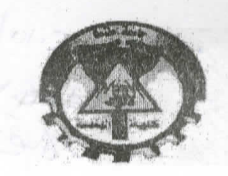
(b) For a coaxial slotted line with characteristic impedance $Z_o = 50\Omega$.

1. Explain why to measure an unknown load, the initial measurement is done using a short circuit load then replaced by the unknown load.
2. **Determine**: **(a)** The operating frequency **(b)** The terminal load impedance Z_L if:
   For short circuit load, the voltage minimum values are recorded at z= 0.55cm, 2.55cm, and 4.55cm. The short circuit is removed and replaced by the unknown load Z_L. The maximum measured voltage is $V_{max} = 4volt$ and the minimum measured voltage is $V_{min} = 2volt$ which are located at z= 0.95cm, 2.95cm, and 4.95cm.

Question (4) [18 marks]

(a) For a parallel plate wave guide (of plate width is W and plates separation is d) operating in the T_M mode, **derive** expression for the modes cutoff frequency.





Electronics and Electrical Comm. Dept.
Total Marks: 90 Marks
First Term

Course Title: **Wave Propagation and Antennas (1)**	Course Code: EEC 3110	Year: 3rd
Date: 21-1-2016	Allowed Time: 3 Hours	No. of Pages: (2)

(b) For air filled ($\varepsilon_r = 1, and\ \mu_r = 1$) parallel plate wave guide of plate width $W = 10cm$ and plates separation $d = 2cm$ determine:-

1. The cutoff frequencies of the first three modes.
2. Determine the operating frequency required to pass only the first mode.
3. For the dominant mode determine ($k_c, k, \beta, and\ v_p$).
4. For the dominant mode determine the bouncing angle θ of its two equivalent waves.

Question (5) [18 marks]

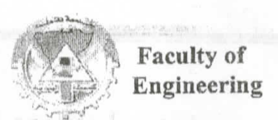
(a) An air filled rectangular waveguide has the following cross-sectional dimensions (5×2)cm. The longitudinal electric field in the waveguide is given by:

$$H_z(x, y, z) = 10^{-5} \cos(20\pi\, X) \cos(50\pi\, Y)\, e^{-j120\pi\, Z} \quad A/m.$$

1. Determine the operating mode and its cutoff frequency.
2. The phase constant β, cutoff wave number k_c, and wave number k.
3. The exact value of the operating frequency.
4. **Check** if other modes can propagate inside the wave guide or not. **Comment** on your answer.
5. Does this wave guide support modes containing (m=0 or n=0). Why?
6. Explain with drawing how this wave guide is fed to support both TE and TM modes

Hint: ($\varepsilon_o = 8.85 \times 10^{-12}\ F/m, and\ \mu_o = 4\pi \times 10^{-7}\ H/m$

Course Coordinator: *Dr. Amr Hussein*

Tanta University | Department of Physics&Mathematics |  Faculty of Engineering

Course Title: statistics analysis	Year: 3d Elec. Power	PME 3114
Date: (First term)2016	Allowed time: 3 hrs	No. of Pages: (2)

Q (1) (25M)

(a) Show that for any value a if $d_i = x_i - a$ of the data

1) The mean $\mu = a + \frac{\sum f_i d_i}{\sum f_i}$ **(2) Standard deviation** $\sigma = \sqrt{\frac{\sum f_i d_i^2}{N} - \left(\frac{\sum f_i d_i}{N}\right)^2}$

where $N = \sum f_i$

(b) From the following data

Class	20-30	30-40	40-50	50-60	60-70	70-80	80-90
frequency	5	7	8	14	6	9	11

Find :

(1) Mean by short cut method
(2) Standard deviation by shortest method
(3) Median for grouped data
(4) Mode for grouped data

(c) The following table show 10students , arranged in alphabetical order , were ranked according to achievements in both the laboratory and lecture of a chemistry course .

Laboratory(x)	7	3	9	2	7	10	4	6	1	5
Lecture (Y)	9	5	10	1	8	9	3	4	2	6

Find :

(1) Rank correlation coefficient (ρ) **(2) correlation coefficient (r)**

Q(2) (25M)

(a) From Caesar cipher encryption text " LQ WKH QDPH RI DOODK " . Find the main text if probability of appear letter Y in condition that letter A appear in the decryption text is 0.1 , probability of appear letter A and not appear letter Y in the decryption text is 0.16875

(b) Consider the following information system with set of condition {Temperature, Pressure, Size}and decision D={Quality}. Use K-mean clustering to grouped the set of objects into two classes(K=2) with centers u_1 and u_5 by coding the data

Object	Temp	Pressure	size	Quality
u_1	normal	Low	fine	good
u_2	normal	Low	small	good
u_3	high	Medium	small	bad
u_4	normal	Medium	fine	bad
u_5	normal	high	small	good
u_6	high	high	fine	good

(c) Acoin tossed if head appear we tossed a fair die and if tail appear we tossed a weighted die with probabilities of appear odd numbers twice like as even numbers find the probability that odd numbers appears .

Q(3)(25M

(a) Show that $\sigma_{x-y}^2 = \sigma_x^2 + \sigma_y^2 - 2r\sigma_x\sigma_y$, Where r is the correlation coefficient between x and y , σ_x is standard deviation of x and σ_y is standard deviation of y

(b) Consider $f(x) = \begin{cases} kx+3 & -3 \le x \le -2 \\ 3-kx & 2 \le x \le 3 \\ 0 & \text{otherwise} \end{cases}$

(i)Find the value of k to make f(x) P.D.F and
(ii)Find accumulative distribution function F(x)
(iii) Find E(3x+5) and V(4x+8)

Q(4)(25M)

(a) Deduce the form of
(i)Expectation E(x)
(ii) Variance V(x)
(iii) Moment generating $M_x(t)$
For Binomial Distribution by used its probability density function

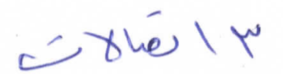
(b) A code of students consists of two letters follows three distinct numbers .If we chose a code random , find the probability that
(i) A code formed by set of letters {A,B,C,D,E} and numbers with sum 6
(i i) A code formed by odd numbers in each digit if we not used a set of letters {A,B,C,D,E} in code

(c) Alight signal consists of n light bulbs .The probability that a bulb will fail before 24- hours work is 2% . find the probability that :

(i) The signal bulb with n=20 contains at least two fail bulbs before 24- hours work
(ii) The signal bulb with n=60 contains at most two fail bulbs before 24-hours work
(ii) The signal bulb with n=30 contains at most two non fail bulbs before 24-hours Work

With my best wishes

Dr. M.Shokry



٢٠١٥/١/٢٦



جامعة طنطا - كلية الهندسة
قسم هندسة الالكترونيات و الاتصالات الكهربية
امتحان نهاية الفصل الدراسى الأول — التاريخ: 2016-1-26
الفرقة / الثالثة
المادة/ الشبكات العصبية — زمن الامتحان/ ٣ ساعات

Answer the following questions:

Question 1: **(Answer two points only)**

a- Perform two training steps of the network in Fig. 1 using the delta learning rule for λ = 1 and c = 0.25. Train the network using the following data pairs

$$\left(x_1 = \begin{bmatrix} 2 \\ 0 \\ -1 \end{bmatrix}, d_1 = -1\right), \left(x_2 = \begin{bmatrix} 1 \\ -2 \\ -1 \end{bmatrix}, d_2 = 1\right)$$

The initial weights are $w^1 = [1 \quad 0 \quad 1]^t$. [Hint: Use $f'(net) = \frac{1}{2}(1 - o^2)$ and $f(net)$ is bipolar continuous.]

b- Figure (2) shows a landmine detection algorithm. Explain the steps of the algorithm, and if we decided to use a neural classifier in this algorithm, from your opinion, suggest its place and how we can apply it.

c- What is meant by cepstral analysis? Explain the way of cepstral feature extraction and how cepstral features are used with neural networks for pattern recognition and speaker identification.

Question 2: **(Answer two points only)**

a- What is meant by MESFET small-signal modeling? For the MESFT small signal model shown in Fig. (3) and having the parameters in Table (1), explain the utilization of neural networks in MESFET small signal modeling.

b- Comment on the number of epochs shown in Table (2) and required for the estimation of the circuit elements in Fig. (3).

c- Explain the behavior of the estimation curves shown in Fig. (4) for the circuit elements in Fig. (3).

Question 3: **(Answer two points only)**

a- The feed-forward network shown in Fig. 5 has been designed to code the grey intensity of a pixel expressed on a continuous scale, $0 \le x \le 1$. The output binary code is $(q_3 q_2 q_1)$. Analyze the network and find each range of x that is converted into the binary codes (0 0 0), . . . , (1 1 1). Assume unipolar binary neurons.

b- For the continuous-time network using the bipolar neurons shown in Fig. 6, obtain discredited differential equations.

c. A single-neuron network using f(net) = sgn(net) as in Fig. 7 has been trained using the pairs of x_i, d_i as shown below:

$$\left(x_1 = \begin{bmatrix} 1 \\ -2 \\ 3 \\ -1 \end{bmatrix}, d_1 = -1\right), \left(x_2 = \begin{bmatrix} 0 \\ -1 \\ 2 \\ -1 \end{bmatrix}, d_2 = 1\right), \left(x_3 = \begin{bmatrix} -2 \\ 0 \\ -3 \\ -1 \end{bmatrix}, d_3 = -1\right)$$

The final weights obtained using the perceptron rule are $w^4 = [3 \quad 2 \quad 6 \quad 1]^t$

Knowing that correction has been performed in each step for c = 1, determine the following weights:

1. w^3, w^2, w^1 by back-tracking the training
2. w^7, w^6, w^5 obtained for steps 4, 5, and 6 of training by reusing the sequence $(x_1, d_1), (x_2, d_2), (x_3, d_3)$.

Question 4: **(Answer two points only)**

a. Implement the Hebbian Learning rule to train the network in Fig. 8 with the initial weight vector :

$$w^1 = \begin{bmatrix} 1 \\ -1 \\ 0 \\ 0.5 \end{bmatrix}$$

using the set of three input vectors as below

$$x_1 = \begin{bmatrix} 1 \\ -2 \\ 1.5 \\ 0 \end{bmatrix}, x_2 = \begin{bmatrix} 1 \\ -0.5 \\ -2 \\ -1.5 \end{bmatrix}, x_3 = \begin{bmatrix} 0 \\ 1 \\ -1 \\ 1.5 \end{bmatrix}$$

for an arbitrary choice of learning constant c = 1.

1. bipolar binary neurons.
2. bipolar continuous neurons with λ = 1.

b. What is meant by the items recognition, classification, autoassociation, and heteroassociation? Use graphical illustrations.

c. The feed-forward network shown in Fig. 9 using bipolar binary neurons is mapping the entire plane x_1, x_2 into a binary *o* value. Find the segment of the x_1, x_2 plane for which o_4 = 1, and its complement for which o_4 = -1.

Question 5: (Answer two points only)

a- What is meant by recurrent neural networks? Show by two examples that the neural network in Fig. (10) tends to equilibrium.

b- Explain how the neural network in Fig. 11 works as a memory.

c- With the aid of Fig. 12, explain simply how image interpolation is performed? What is the role of neural networks in this task?

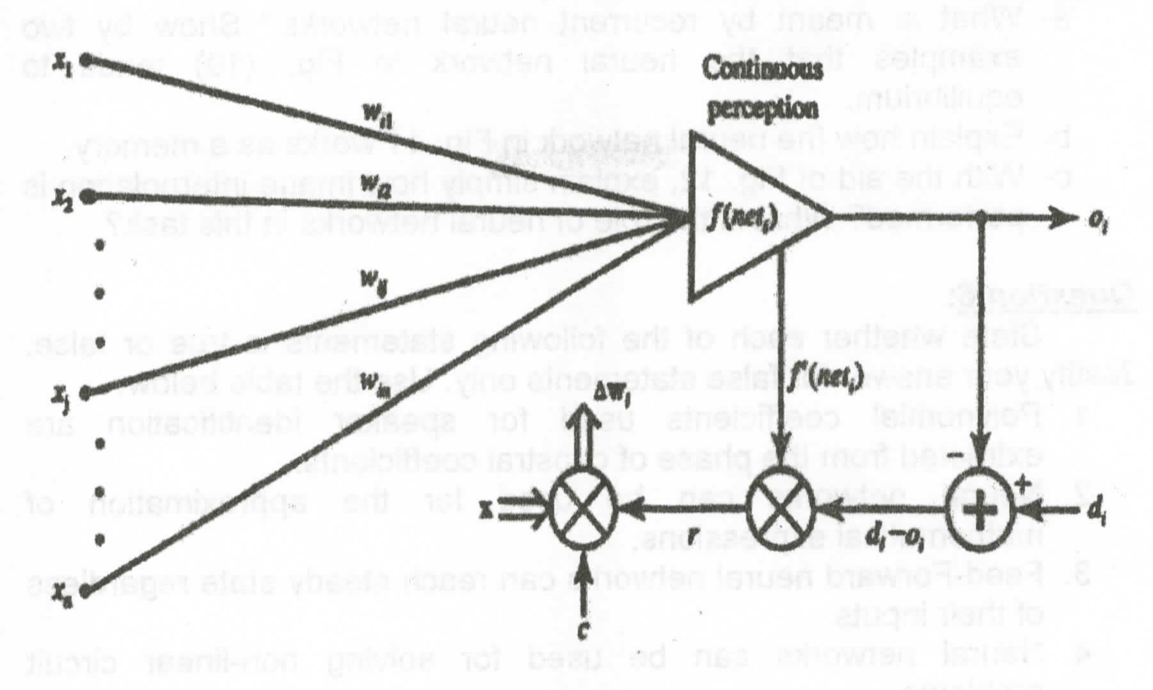
Question 6:

State whether each of the following statements is true or false. Justify your answer for false statements only. Use the table below.

1. Polynomial coefficients used for speaker identification are extracted from the phase of cepstral coefficients.
2. Neural networks can be used for the approximation of mathematical expressions.
3. Feed-Forward neural networks can reach steady state regardless of their inputs.
4. Neural networks can be used for solving non-linear circuit problems.
5. The bias input to neurons is used to make all their outputs positive.
6. Increasing the number of neurons in a neural network leads always to faster convergence of the network in the training process.
7. The energy compaction property of the DCT leads to high recognition rates with neural networks.
8. The error back-propagation algorithm is used in training feedback neural networks only.
9. For a classification problem having three clusters, a single neuron output layer is appropriate.
10. Mel frequency cepstral coefficients depend in there calculations on a linear filter bank.
11. In pattern recognition problems, it is required that small perturbations in neural network inputs must lead to totally different outputs.
12. It is possible to build equivalent electrical circuit models to neural networks.
13. Unsupervised neural network learning requires a desired target output.
14. For the perceptron learning rule, the learning signal is the difference between the desired and actual neuron's response.
15. The Widrow-Hoff learning rule is appropriate for unsupervised neural networks.

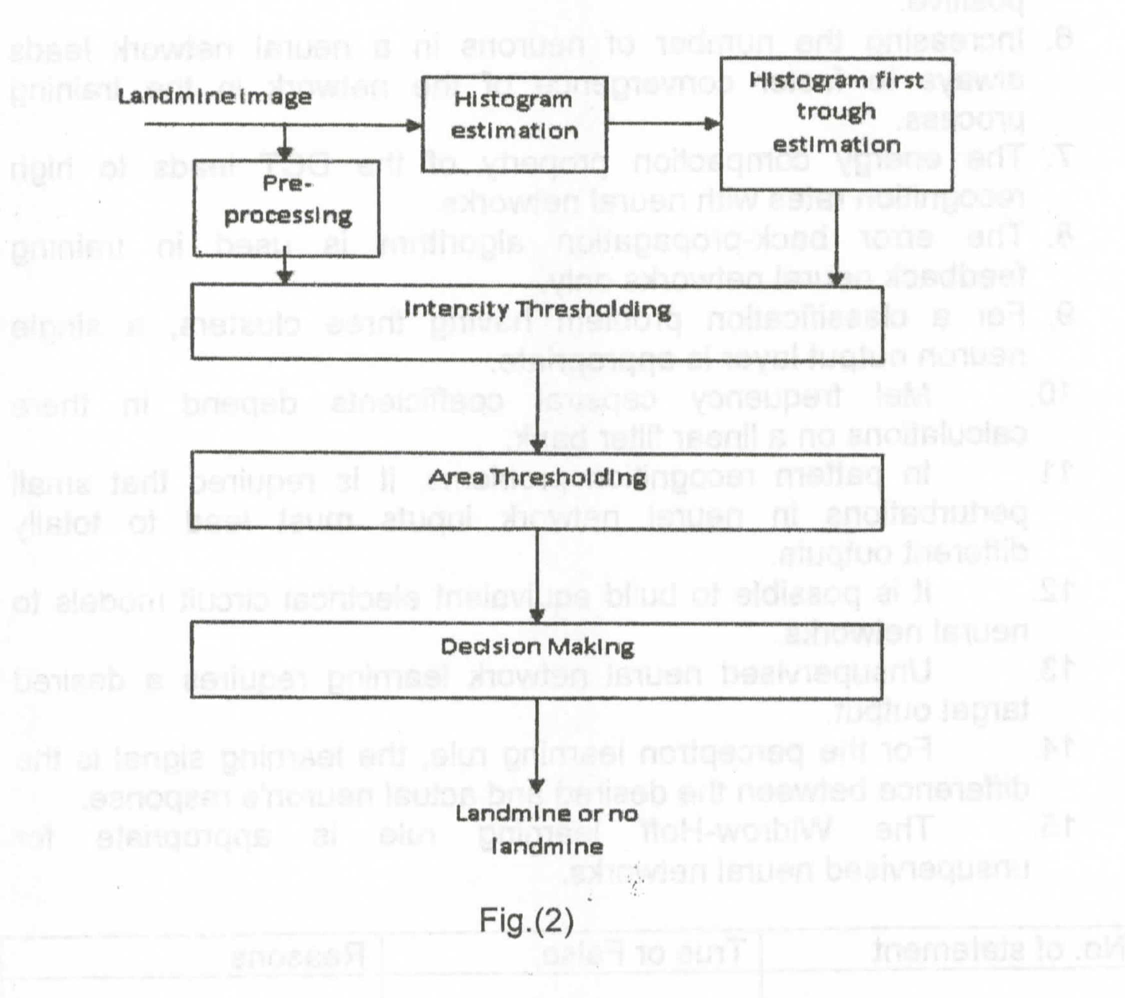
No. of statement	True or False	Reasons

Best wishes.



x_1
x_2
x_j
x_n
w_{i1}
w_{i2}
w_{ij}
w_{in}
Continuous perception
$f(net_i)$
o_i
$f'(net_i)$
ΔW_i
x
r
$d_i - o_i$
d_i
c

Fig.(1)



Landmine image
Histogram estimation
Histogram first trough estimation
Pre-processing
Intensity Thresholding
Area Thresholding
Decision Making
Landmine or no landmine

Fig.(2)

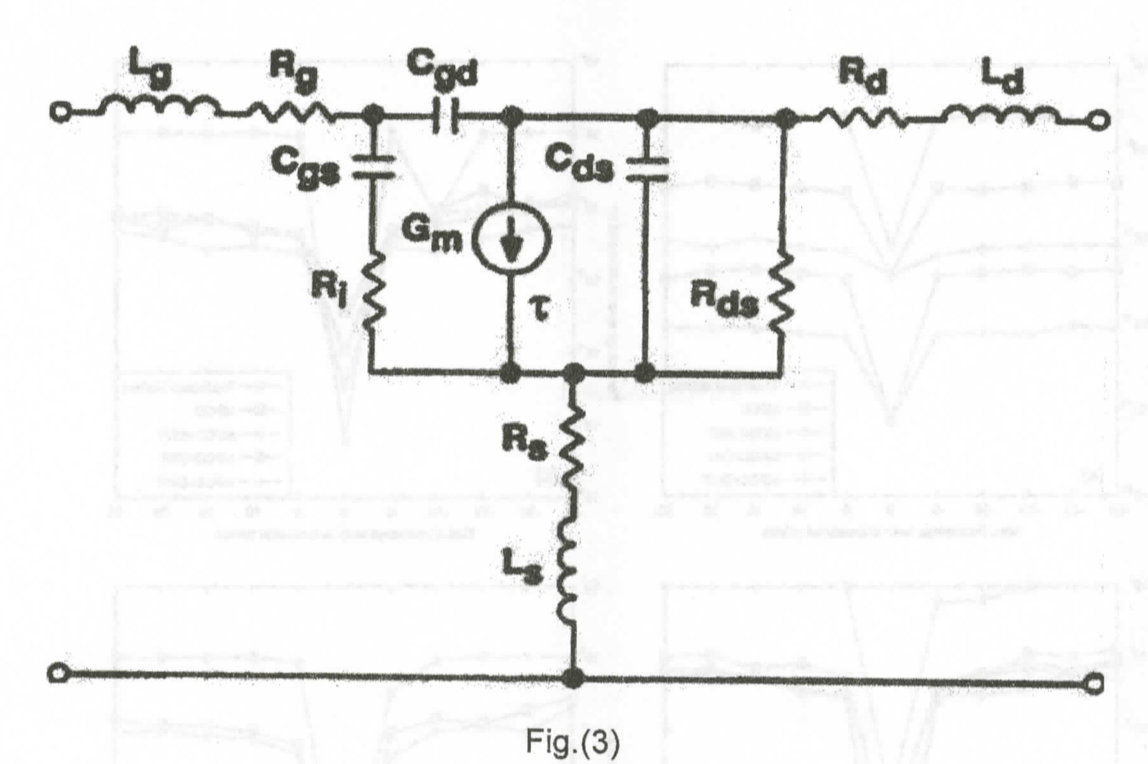


Fig.(3)

Table (1)

Frequency (GHz)	S_{11} Magnitude	S_{11} Angle (°)	S_{21} Magnitude	S_{21} Angle (°)	S_{12} Magnitude	S_{12} Angle (°)	S_{22} Magnitude	S_{22} Angle (°)
2	0.98	−24	4.56	156	0.02	73	0.53	−10
4	0.93	−51	4.31	136	0.04	62	0.5	−25
6	0.88	−72	3.83	118	0.05	51	0.48	−35
8	0.84	−98	3.47	100	0.06	38	0.43	−51
10	0.79	−122	2.99	82	0.06	23	0.38	−68
12	0.79	−140	2.64	67	0.07	18	0.38	−83
14	0.78	−154	2.41	55	0.07	10	0.39	−93
16	0.78	−166	2.27	44	0.07	5	0.36	−101
18	0.77	178	2.16	30	0.08	−2	0.32	−113
20	0.76	159	2.04	15	0.09	−13	0.27	−131
22	0.79	141	1.82	−2	0.09	−20	0.27	−163
24	0.78	132	1.52	−13	0.09	−21	0.3	176
26	0.81	129	1.31	−21	0.09	−19	0.39	168

Table 2. The number of epochs required in each method for the intrinsic elements of the CF001-01 model.

Method of estimation	C_{gs}	R_i	C_{gd}	g_m	τ	C_{ds}	R_{ds}
Traditional method	2,315	239	800	1,050	1199	1,349	815
MFCC method	463	9	311	500	17	2,017	167
DCT method	13	20	1210	931	5	884	91
DST method	11	172	28	445	4	15	15
DWT method	13	100	557	97	6	534	10,000

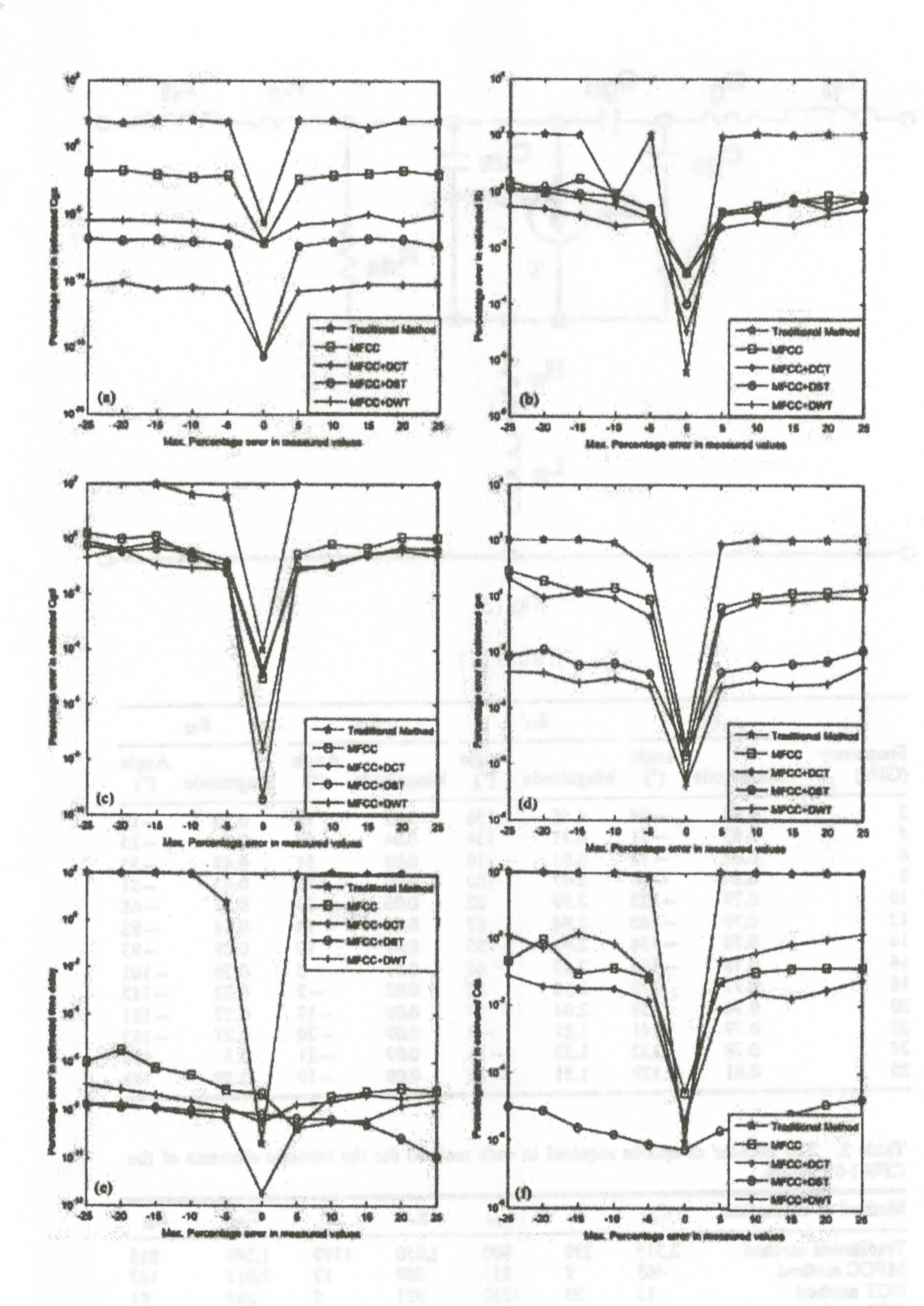
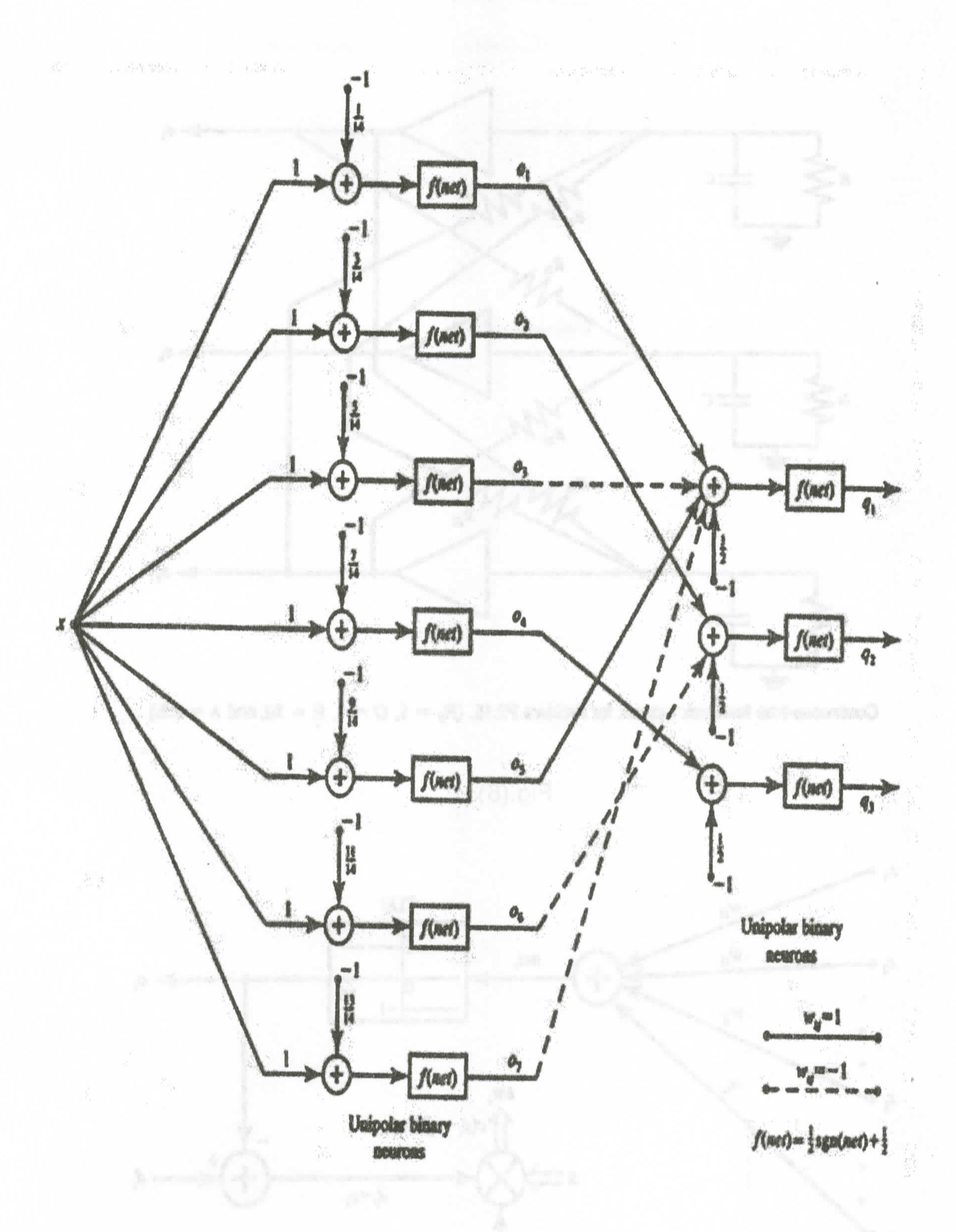
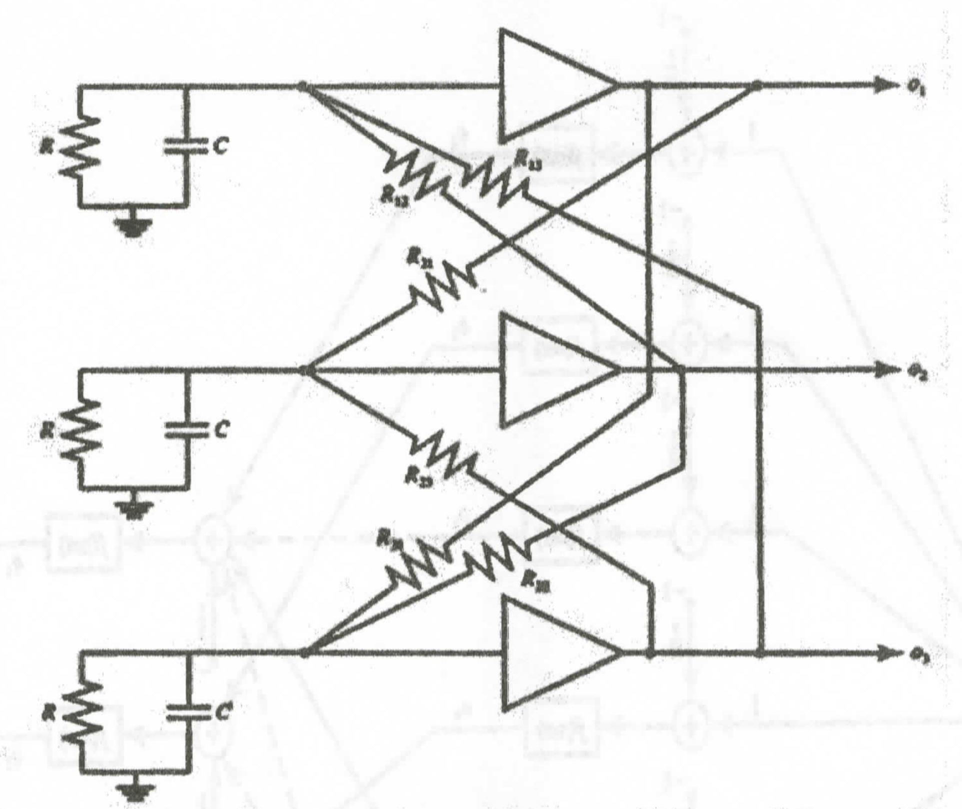

(a)
(b)
(c)
(d)
(e)
(f)
Traditional Method
MFCC
MFCC+DCT
MFCC+DST
MFCC+DWT
Max. Percentage error in measured values

Fig.(4)



x
1
−1
f(net)
o_1
o_2
o_3
o_4
o_5
o_6
o_7
q_1
q_2
q_3
Unipolar binary neurons
Unipolar binary neurons
$w_{ij}=1$
$w_{ij}=-1$
$f(net)=\frac{1}{2}\text{sgn}(net)+\frac{1}{2}$

Fig. (5)



Continuous-time feedback network for Problem P2.15. (R_{ij} = 1, C = 1, R = 10, and λ = 2.5.)

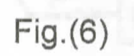


Fig.(6)

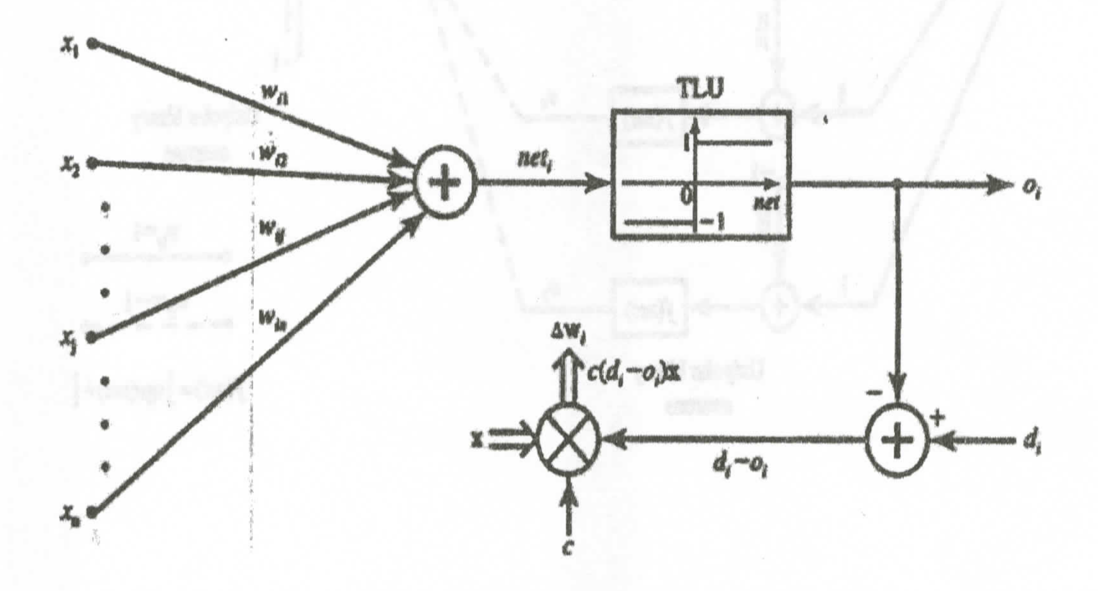


Fig.(7)

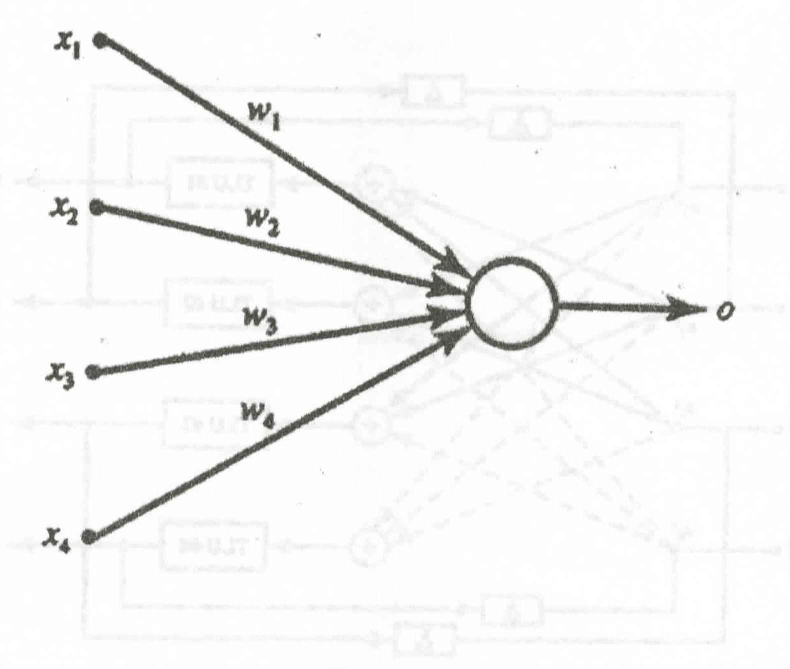

x_1
x_2
x_3
x_4
w_1
w_2
w_3
w_4
o

Fig. (8)

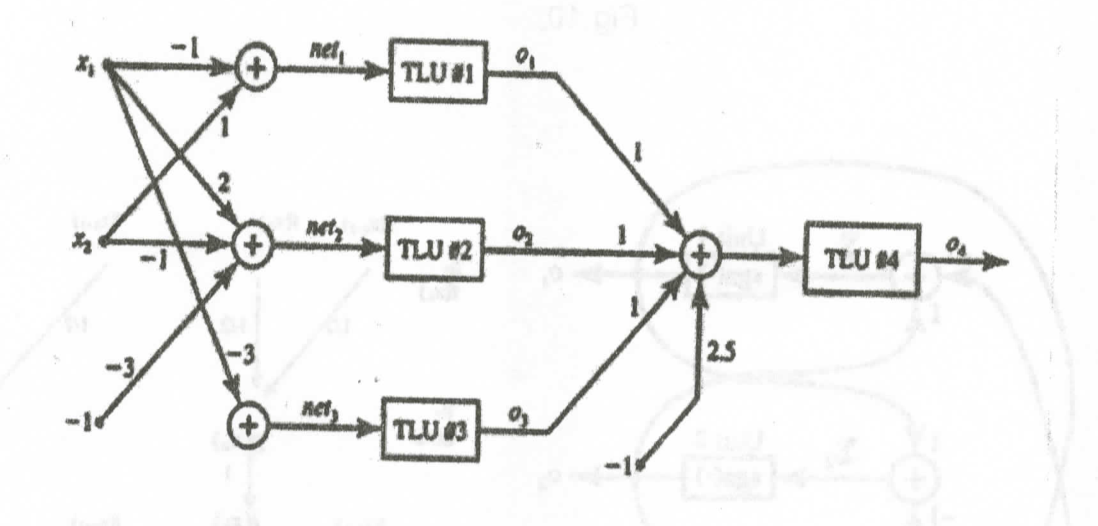

x_1
x_2
-1
-1
1
2
-1
-3
-3
net_1
net_2
net_3
TLU #1
TLU #2
TLU #3
o_1
o_2
o_3
1
1
1
2.5
-1
TLU #4
o_4

Fig. (9)

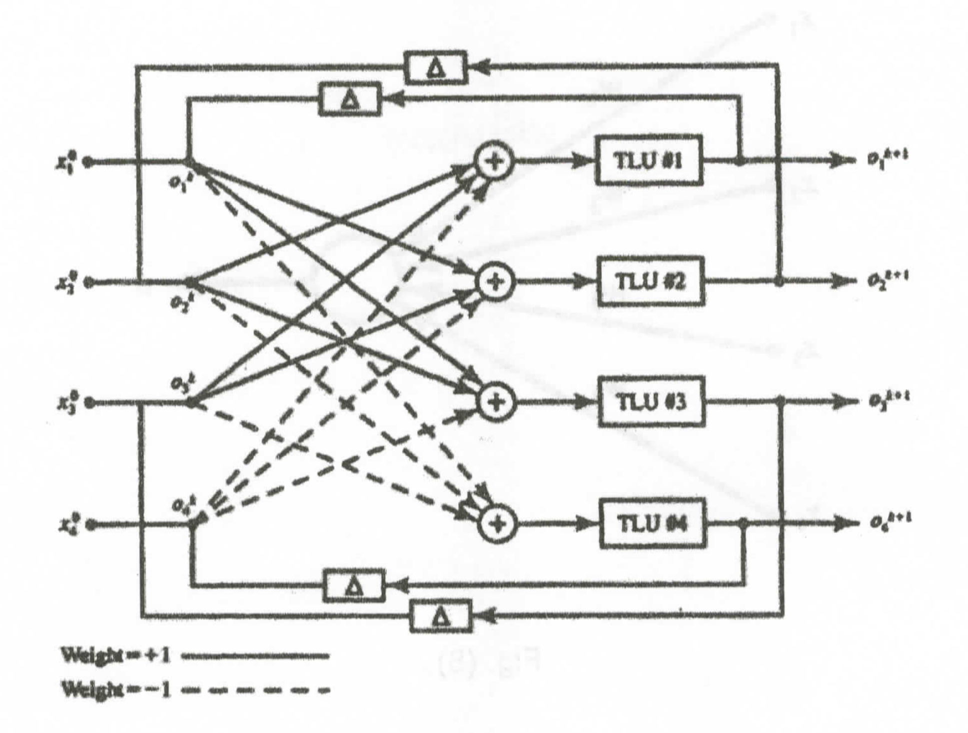


Fig.10

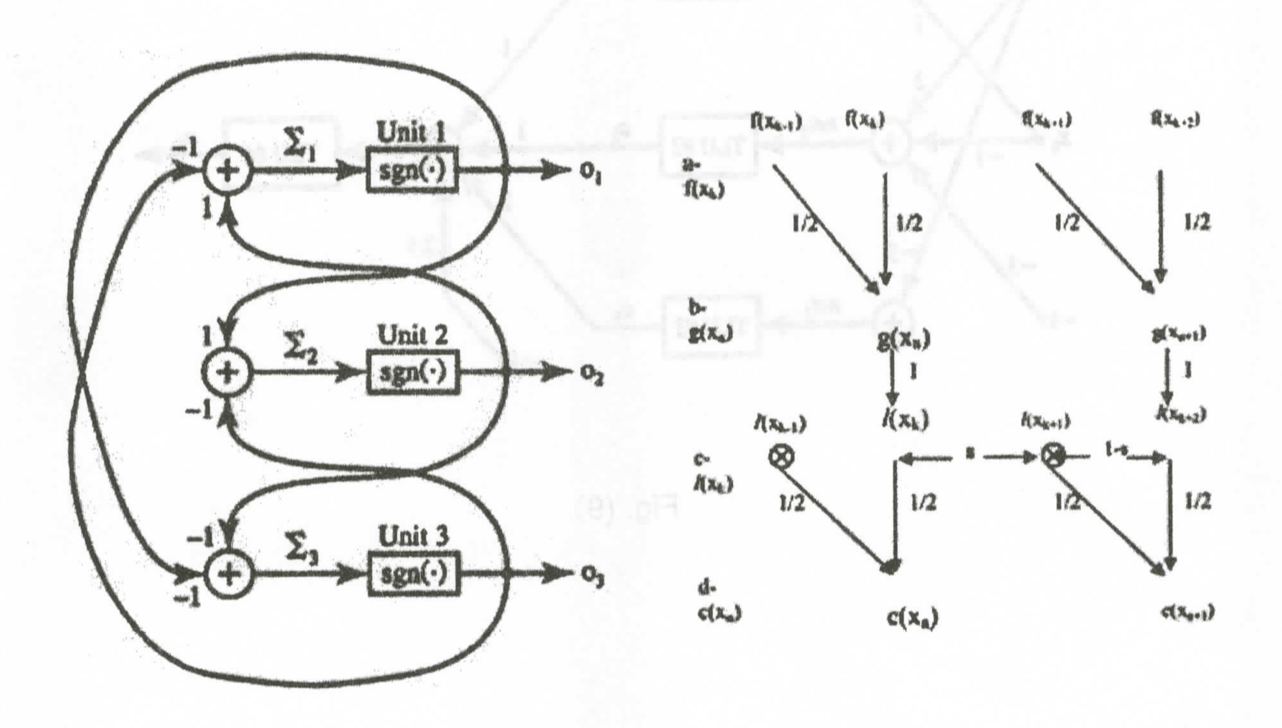


Fig. 11

Fig. 12